

Section 3.4 - Predictions & Lines: $y = mx + b$

Curriculum Outcomes	Related Activities	Page in Text
<ul style="list-style-type: none"> determine the slope and y-intercept of a line from a table of values 	<ul style="list-style-type: none"> an investigation explores the connection between the values of m and b in an equation, the graph of the equation, and the original situation 	118
<ul style="list-style-type: none"> determine the equation of a line using the slope and y-intercept 	<ul style="list-style-type: none"> a Focus shows the connection between the graph, equation, and the m and b and demonstrates how slope can be found and why it is important 	117
<ul style="list-style-type: none"> rearrange equations 	<ul style="list-style-type: none"> students solve problems using the skills they have learned with writing equations in the form $y = mx + b$ 	122
	<ul style="list-style-type: none"> students investigate how to find equations of straight lines from limited information and use the equations to solve problems 	126
<ul style="list-style-type: none"> graph by constructing a table of values, by using graphing technology, and when appropriate by intercept-slope method 	<ul style="list-style-type: none"> students rearrange equations and formulas in order to graph the equation of enter formulas into a spreadsheet. 	128

- The equations we have been dealing with are linear equations or **equations of lines**.
- Equations of lines can be written in **$y = mx + b$ format** or **slope y-intercept form** which is also known as **standard form**.
- To be able to determine the equation of a line we need 2 things:
 - a **slope**
 - a **point on the line**

SLOPE:

- the steepness of a line
- in equation form it is the coefficient of the variable x.
- in the format $y = mx + b$ $m = \text{slope}$

$$y = 4x + 8$$

$$y = 2x + 4$$



Types of Slopes:

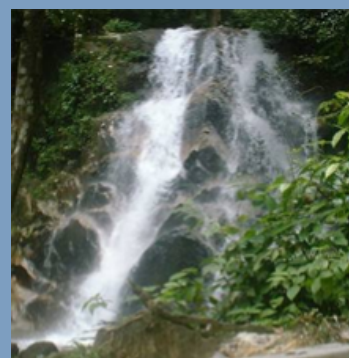
Slope

Positive

Negative





Undefined

Zero



Steepness of Slopes:

Examples of Slopes for Steepness

			
Not Steep	A Little Steeper	Even Steeper	Very Steep
Slope = 0.1	Slope = 1	Slope = 2	Slope = 4

Small slope

Large slope

How to Find Slope:

① From the equation $y = mx + b$

the number found
where the "m" is

Examples:

1. $y = -2x + 3$

$m = -2$
 $b = +3$



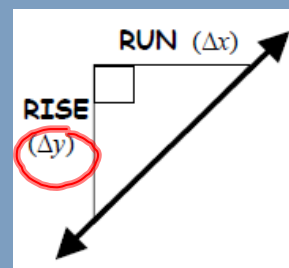
2. $y = \frac{1}{3}x - 2$

$m = \frac{1}{3}$
 $b = -2$

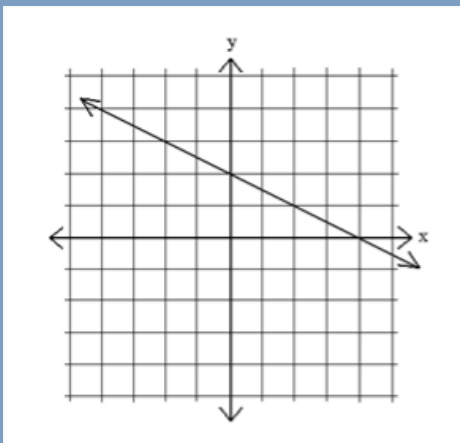
②

From a graph using rise
run

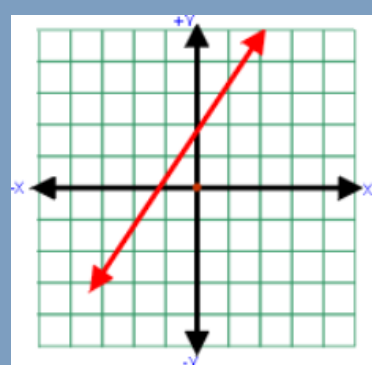
$$m = \frac{\Delta y}{\Delta x}$$

Examples:

1.



2.



③

From 2 co-ordinate points

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \begin{array}{l} \text{rise} \\ \text{run} \end{array}$$

Examples:

1. $(2, 7)$ & $(5, 1)$
 x_1, y_1 x_2, y_2

$$m = \frac{1-7}{5-2} = \frac{-6}{3} = -2$$

$$m = -2$$

2. $(-2, 5)$ & $(-5, 5)$
 x, y x, y

$$m = \frac{5-5}{-5-(-2)} = \frac{0}{-3}$$

$$m = 0$$

Find slope:

$$\textcircled{1} \quad \begin{matrix} (-2, 5) \\ x_1, y_1 \end{matrix}, \begin{matrix} (3, -6) \\ x_2, y_2 \end{matrix} \quad m = \frac{-6-5}{3-(-2)} = \frac{-11}{5}$$

$$m = -2\frac{1}{5}$$

$$\textcircled{2} \quad \begin{matrix} (8, -4) \\ x_2, y_2 \end{matrix}, \begin{matrix} (0, 2) \\ x_1, y_1 \end{matrix} \quad m = \frac{-4-2}{8-0} = \frac{-6}{8} = \frac{-3}{4}$$

$$m = \frac{-3}{4}$$

$$\textcircled{3} \quad \begin{matrix} (6, 7) \\ x_1, y_1 \end{matrix}, \begin{matrix} (6, 9) \\ x_2, y_2 \end{matrix}$$

$$m = \frac{9-7}{6-6} = \frac{2}{0} \quad \underline{\underline{\text{undefined}}}$$

Pg. 129 # 2, 3

show work for #2

$$2.a. \begin{matrix} (1, 1) \\ x_1, y_1 \end{matrix} \begin{matrix} (4, 3) \\ x_2, y_2 \end{matrix}$$

Take out

$$\frac{3-1}{4-1} = \frac{2}{3}$$

$$m = \frac{2}{3}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\textcircled{2} e. \begin{matrix} (5, 3) \\ x_2, y_2 \end{matrix} \begin{matrix} (7, 3) \\ x_1, y_1 \end{matrix}$$

$$\text{slope } \frac{3-3}{5-7} = \frac{0}{-2} \quad m = 0$$

$$\textcircled{h} \begin{matrix} (2, -3) \\ x_1, y_1 \end{matrix} \begin{matrix} (0, 4) \\ x_2, y_2 \end{matrix}$$

$$\frac{4-(-3)}{0-2} = \frac{7}{-2} \quad m = -3.5$$

$$\textcircled{3} g. \begin{matrix} (0.5, 3) \\ x_1, y_1 \end{matrix} \begin{matrix} (2, -3) \\ x_2, y_2 \end{matrix}$$

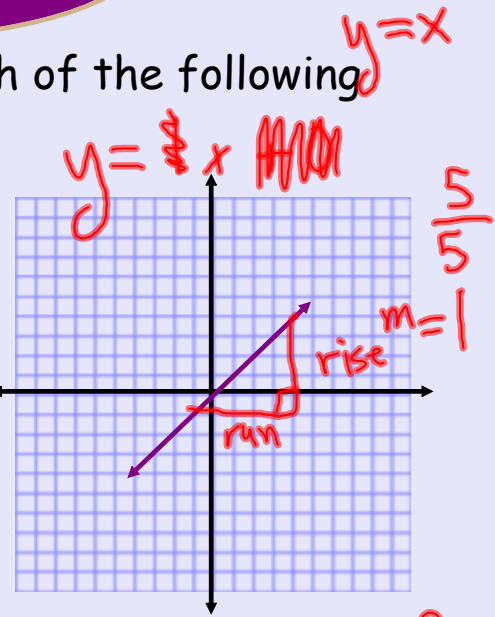
$$\frac{-3-3}{2-0.5} = \frac{-6}{1.5} = -4 \quad m = -4$$

Practice:

State what the slope is for each of the following questions:

1. $y = -2/3x + 2$

2.



3. $(1,4)$ $(-8,-7)$
 $x_1 y_1$ $x_2 y_2$

$$\frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{\Delta y}{\Delta x} = \frac{-7 - 4}{-8 - 1} = \frac{-11}{-9}$$

$$m = \frac{11}{9} = 1\frac{2}{9}$$

Pg. 129
 #2,3 Show your work for #2

For example:
 #2a. $(1,1)$ $(4,3)$ \leftarrow
 $x_1 y_1$ $x_2 y_2$
 $m = \frac{3-1}{4-1} = \frac{2}{3}$ $(m = \frac{2}{3})$

slope (m) $m = \frac{y_2 - y_1}{x_2 - x_1}$

2.f. $(-3,4)$ $(5,-2)$
 $x_1 y_1$ $x_2 y_2$
 $\frac{-2-4}{5-(-3)} = \frac{-6}{8}$ $m = \frac{-6}{8}$
 $m = -0.75$

$\frac{4-(-2)}{-3-5} = \frac{6}{-8}$ $(m = \frac{-6}{8})$

g. $(-3,-1)$ $(-5,7)$
 $\frac{-1-7}{-3-(-5)} = \frac{-8}{+2}$ $(m = -4)$

3i. $(2\frac{1}{5}, -3)$ $(-3\frac{1}{2}, \frac{1}{2})$
 $(2.2, -3)$ $(-3.5, 0.5)$
 $x_1 y_1$ $x_2 y_2$
 $\frac{0.5-(-3)}{-3.5-2.2} = \frac{3.5}{-5.7}$ $(m = -0.61)$

Rearranging Equations
into the form

$$\boxed{y = mx + b}$$

↑ ↑
slope y-int.

Example

$$\begin{aligned} 2y - 4 &= 7x \\ +4 &\quad +4 \\ \hline 2y &= 7x + 4 \\ \frac{2y}{2} &= \frac{7x + 4}{2} \end{aligned}$$

$$\boxed{y = \frac{7}{2}x + 2}$$

$$1) \quad \cancel{5x} + 3y = 7$$

$$3) \quad 2y - 3 = 7x$$

$$2) \quad 4x = 3 - 5y$$

$$4) \quad 5 = 3y - 4x$$

Rearrange ($y = mx + b$), $m =$, $b =$

$$\begin{aligned} 1) \quad \cancel{3y} &= \frac{-5x + 7}{3} \\ y &= \frac{-5}{3}x + \frac{7}{3} \end{aligned}$$

$$\begin{aligned} 2) \quad \cancel{3} - 5y &= 4x \\ -5y &= 4x - 3 \\ \frac{-5y}{-5} &= \frac{4x - 3}{-5} \\ y &= \frac{-4}{5}x + \frac{3}{5} \end{aligned}$$

$$0 = 2 - 3y + 4x$$

$$+3y \quad +3y$$

$$\frac{3y}{3} = \frac{4x + 2}{3}$$

$$y = \frac{4}{3}x + \frac{2}{3}$$

$$y = -x + \text{---}$$

Pg. 129 #1 (e-h), 2 (e-h) *

Pg. 132 #1 ($y=mx+b$)

Pg. 129

#1 e. $m = \frac{3}{6} = \frac{1}{2}$

f. $m = -\frac{1}{2}$

g. $m = 0$

h. $m = \text{undefined}$

#2 e. $(5,3)$ $(7,3)$
 x_1, y_1 x_2, y_2

$$m = \frac{3-3}{7-5} = \frac{0}{2}$$

$$m = 0$$

f. $m = \frac{-2-4}{5-(-3)}$

$$m = \frac{-6}{8} = -\frac{3}{4}$$

g. $m = \frac{-1-7}{-3-5} = \frac{-8}{-8} = 1$

h. $m = \frac{4-(-3)}{0-2} = \frac{7}{-2} = -3\frac{1}{2}$

$$= -\frac{7}{2}$$

Pg. 132 #1

$$a) \quad \cancel{5x} + 3y = 7 \quad \cancel{-5x}$$

$$\frac{3}{3}y = \frac{-5x + 7}{3}$$

$$y = -\frac{5}{3}x + \frac{7}{3}$$

$$d) \quad 7x + 2 = -3y$$

$$\frac{3y}{-3} = \frac{7x + 2}{-3}$$

$$y = -\frac{7}{3}x - \frac{2}{3}$$

Pg. 132 #1 Rearranging Equations into the form $y = \underset{\substack{\uparrow \\ \text{slope}}}{m}x + \underset{\substack{\uparrow \\ \text{y-int.}}}{b}$

$$d) \quad 7x + 2 = -3y$$

$$\frac{-3y}{-3} = \frac{7x + 2}{-3}$$

$$y = -2.\bar{3}x - 0.\bar{6}$$

$$k) \quad 0 = 2 - 3y + 4x$$

$$+3y \quad +3y$$

$$\frac{3y}{3} = \frac{2 + 4x}{3}$$

$$y = \frac{2}{3} + \frac{4}{3}x$$

$$y = \frac{4}{3}x + \frac{2}{3}$$

$$y = \underline{\underline{mx}} + b$$

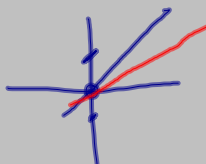
$$y = \underset{\uparrow}{m}x + \underset{\uparrow}{b}$$

$$h) \quad 3x - 4y = 0$$

$$\cancel{-3x} \quad \uparrow \quad \cancel{-3x}$$

$$\frac{-4y}{-4} = \frac{-3x}{-4}$$

$$y = \overset{m}{\left(\frac{3}{4}\right)}x + \overset{+5}{\left(0\right)}$$



Pg. 117 - Focus G
 → you will learn how an equation ($y=mx+b$) relates to a graph

Slope - means "rate"
 - growth rate
 - speed
 - \$/hr

Example:
 - speed (m/s)
 (km/hr)

y-int. = 20 → $y = mx + b$
 $y = mx + 20$

slope? $m = \frac{y_2 - y_1}{x_2 - x_1}$
 $m = \frac{40 - 20}{10 - 0}$
 $m = \frac{20}{10}$
 $m = 2$

$y = 2x + 20$ base fee = 20
 hourly rate = \$2/hr.

Pg

Connecting Equations & Graphs of Lines:

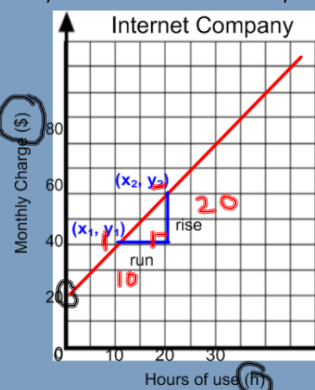
Focus G: Page 117

Suppose you were only given a graph representing an Internet company and you had to decide if this company was going to work for you. What information could you gain?

- To find the **hourly rate** (charge/hour), we would find the **slope (m)**:

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

- To find the **initial (base) rate**, find the **y-intercept (b)**



- Calculate slope (units!)

- y-intercept = 20 (flat fee)

- Write the eqn. of the line ($y=mx + b$)
 $y = 2x + 20$

$(10, 40)$ and $(20, 60)$
 x_1, y_1 x_2, y_2
 $m = \frac{60 - 40}{20 - 10} = \frac{20}{10}$
 $m = 2/\text{hr.}$

Pg. 117

- y-int. is 20
- slope (m) $m = \frac{y_2 - y_1}{x_2 - x_1}$ $\begin{matrix} (10, 40) \\ (20, 60) \end{matrix}$

$$= \frac{60 - 40}{20 - 10} = \frac{20}{10} = 2$$

$$m = 2$$
- Eqn. of the line: $y = mx + b$
- 5 hours of use: $y = 2(5) + 20$ $y = 2x + 20$
- $y = 10 + 20$ $\$2/\text{hr}$ 20 fee
- $y = 30$

It costs \$30 for 5 hrs. of use.

$y = \overset{\downarrow}{m}x + \overset{\downarrow}{b}$ $m = \frac{y_2 - y_1}{x_2 - x_1}$

"rate" means slope

"basic fee" means y-int.

Investigation 5 Pg. 118-119

Answer A, B, C

#1-4

(A) $y = mx + b$ $m = \text{slope}$
 $b = \text{y-int.}$

Company 1 (12, 45) (0, 10)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{45 - 10}{12 - 0} = \frac{35}{12} \quad m = 2.9$$

$$y = 2.9x + 10$$

(B) Company 2 (0, 20) (10, 35)

$$m = \frac{35 - 20}{10 - 0} = \frac{15}{10} \quad m = 1.5$$

$$y = 1.5x + 20$$

(C) Company 3 (2, 20) (8, 35)

$$m = \frac{35 - 20}{8 - 2} = \frac{15}{6} \quad m = 2.5$$

$$y = 2.5x + 15$$

Domain $\{x \mid x \geq 0, x \in \mathbb{R}\}$

Range $\{y \mid y \geq 15, y \in \mathbb{R}\}$

Investigation #5 - Page 119

The rates for 3 Internet companies are shown on the graph below:

	y-intercept (c-intercept)	slope	Equation in (Standard Form)	Equation of Graph
Company 1				
Company 2				
Company 3				

Company 1: $c = 3h + 10$
Company 2: $c = 20 + 1.5h$
Company 3: $c = 15 + 2.5h$

1. Suppose you have \$50.00 per month to spend. Which company would you go with?

2. You can read any two points on a graph to find out the hourly cost for a length of time. Find the average hourly cost of Company 2.

#1

$$\begin{array}{r} 50 = 2.9x + 10 \\ -10 \quad -10 \\ \hline 40 = 2.9x \\ \frac{40}{2.9} = \frac{2.9x}{2.9} \quad x = 13.8 \end{array}$$

C#1 \rightarrow 13.8 hrs

$$\begin{array}{r} 50 = 1.5x + 20 \\ -20 \quad -20 \\ \hline 30 = 1.5x \\ \frac{30}{1.5} = \frac{1.5x}{1.5} \quad x = 20 \end{array}$$

C#2 \rightarrow 20 hrs

$$\begin{array}{r} 50 = 2.5x + 15 \\ -15 \quad -15 \\ \hline 35 = 2.5x \\ \frac{35}{2.5} = \frac{2.5x}{2.5} \quad x = 14 \text{ hrs} \end{array}$$

I would use Company 2
because you can get the
greatest number of hours.
20 hrs.

Pg. 118

Eqn. for C. 1, 2, 3

$$y = mx + b$$

↑ ↑

C Company 3

Find slope

(6, 30) (2, 20)

$$\frac{\$}{\text{hr}} \quad \frac{30 - 20}{6 - 2} = \frac{10}{4} = 2.5$$

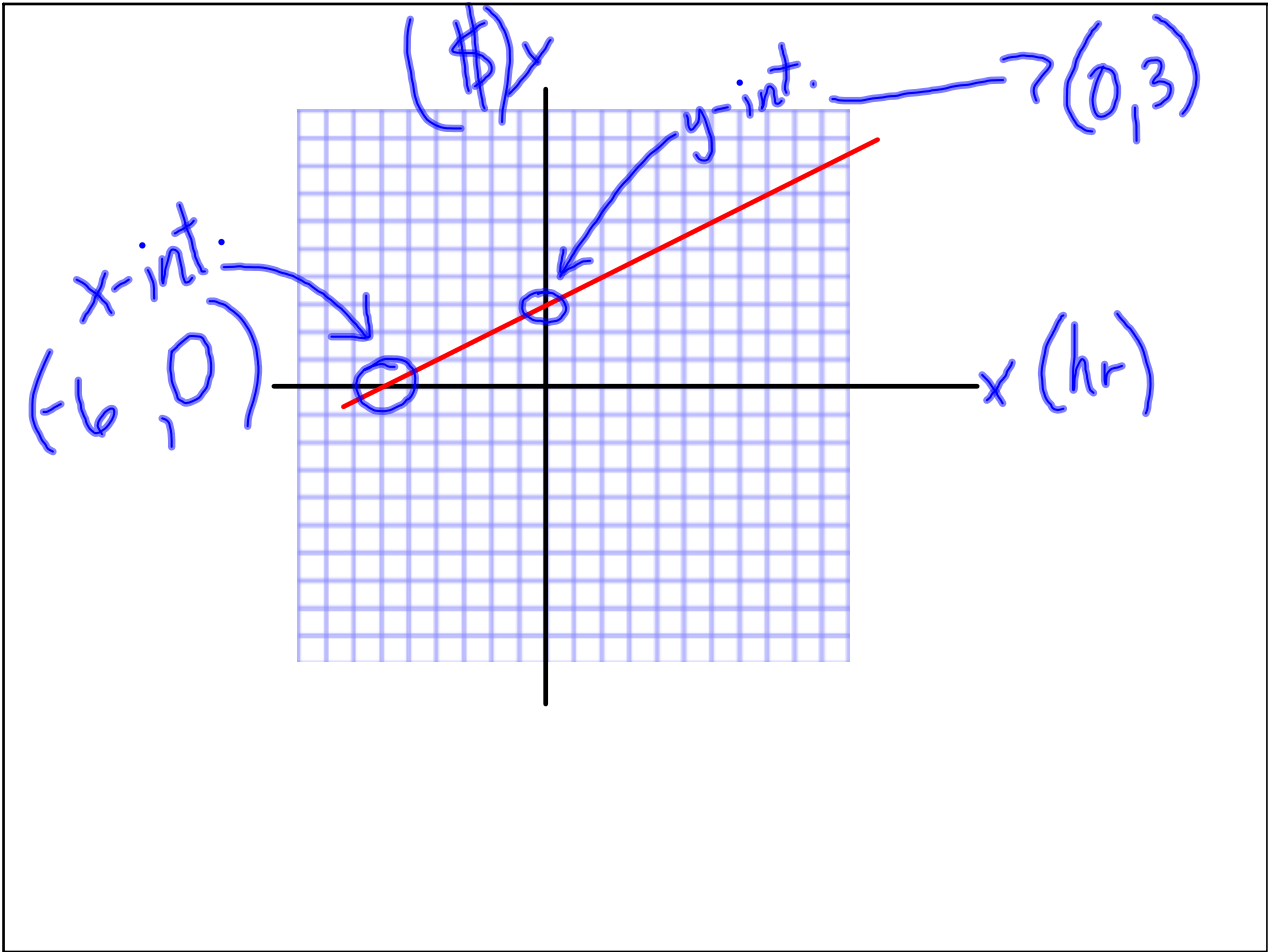
$\$2.50/\text{hr.}$

C.

$$y = 2.5x + 15$$

↑
\$/hr

↑
flat fee



Helpful Hints for Investigation 5 (Pg.119)

- #2. the c-intercept = y-intercept
the h-intercept = x-intercept
(just using different labels)
- Look at each graph and estimate values
 - what does each value mean?
 - you don't need help with this one!

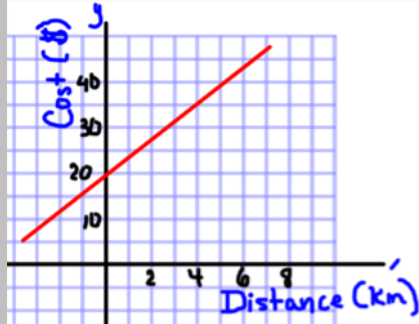
#3 (you did the same thing that it is asking when you found slope)

#4 Just explain what someone would have to do to find out hourly cost and base fare from a graph.....

Warm-up #16

1. Calculate the slope of a line that passes through the points (5, 9) and (8, 2). (SHOW YOUR WORK)

2. Find the slope and y-intercept from the graph:



3. Write the equation of the line from #2.

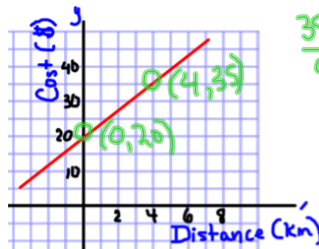
4. What does the slope represent in this situation (in #2) and what is the base fee?

Warm-up #16

1. Calculate the slope of a line that passes through the points (5, 9) and (8, 2). (SHOW YOUR WORK)

$$m = \frac{9-2}{5-8} = \frac{7}{-3} = -\frac{7}{3}$$

2. Find the slope and y-intercept from the graph:



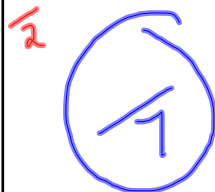
$$\frac{35-20}{4-0} = \frac{15}{4} = 4$$

$$y\text{-int} = 20$$

3. Write the equation of the line from #2.

$$y = 4x + 20$$

4. What does the slope represent in this situation (in #2) and what is the base fee?



$$= 20$$

Cost/distance
\$/km

Example: To deliver soil, Tip Top Soil has a fixed charge plus a charge per "yard" of soil as shown in the graph:

a) Write an equation for the cost to deliver soil.

Use the slope y-intercept form:

$$(y = mx + b)$$

Remember you will need:

- Slope (m) (cost/yard)
- y-intercept (b)

$$m = \frac{20-50}{0-6} = \frac{-30}{-6} = +5$$

$$b = 20$$

b) How many yards of soil can you purchase for \$125.00?

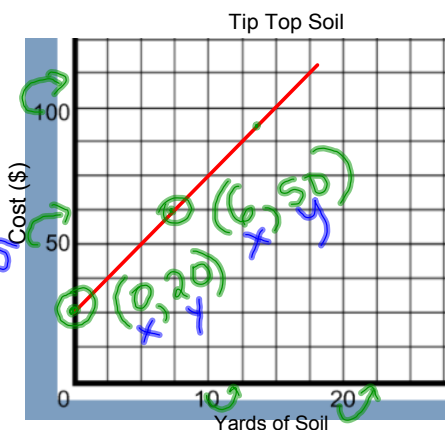
$$y = 5x + 20$$

$$125 = 5x + 20$$

$$-20 \quad -20$$

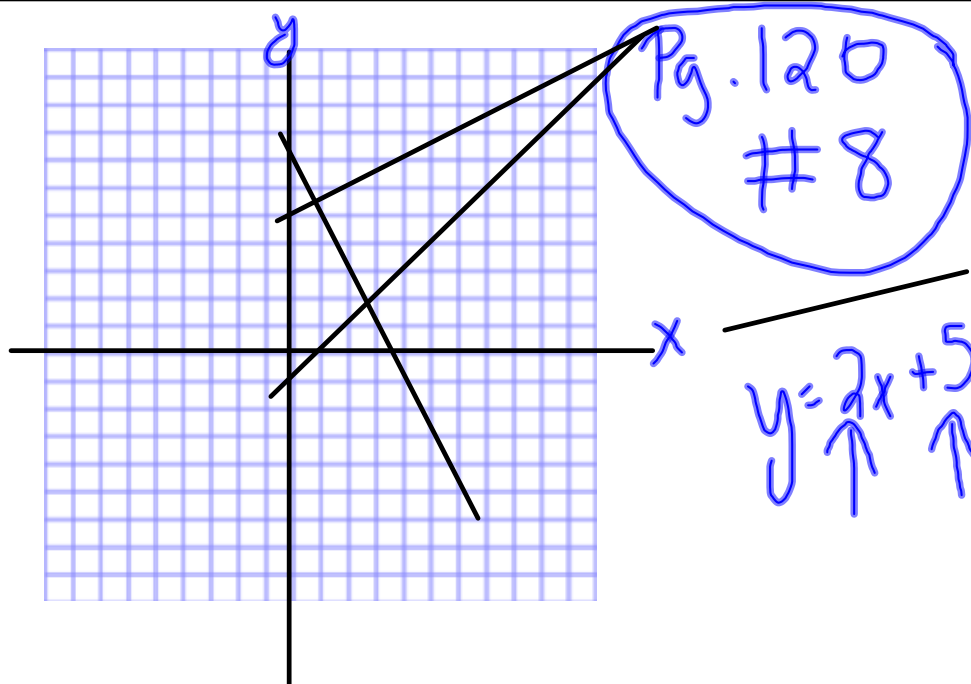
$$105 = 5x$$

$$\frac{105}{5} = \frac{5x}{5} \quad x = 21$$



Classwork/Homework

Pg. 119-121 # 5-12



Pg. 119 #5

(a) Speed: km/hr slope = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{km}}{\text{h}}$

slope = $m = \frac{y_2 - y_1}{x_2 - x_1}$ $(0, 100)$
 $(10, 1100)$

$m = \frac{1100 - 100}{10 - 0} = \frac{1000}{10}$

$m = 100$ $\Rightarrow y = 100x + 100$
 100 km/hr

The car is going 100 km/hr for the entire trip.

(b) how far? - km $y\text{-int.}$
 $100 \text{ km from home.}$

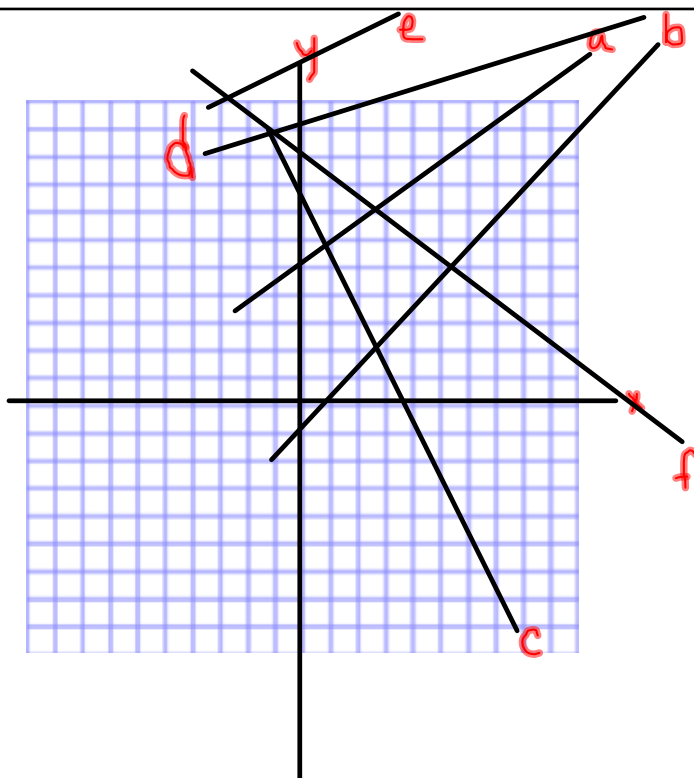
#6 $y = mx + b$ a) Earnings doesn't depend on # of items sold.
 b) $m = 5$ but $y = 5x$

#7 a) $50¢$ b) $\$600$ c) $y = \frac{1}{0.5}x + 600$

#8 a) $y = 2x + 5$ $\$2/\text{hr.}$
 $\$5$
 $y = 2x + 5$
 $y = 4x - 1$

Pg. 120-121

#8



a) $y = 2x + 5$
 b) $y = 4x - 1$
 c) $y = -5x + 7$
 d) $y = 0.5x + 10$
 e) $y = 15 + x$
 f) $y = -2x + 8$

ANSWERS

Classwork/Homework

Pg. 119-121 # 5-12

#5 a) To find the speed, you need to find slope
 $\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$ → You need any two points from the graph
 $(0, 100)$ and $(10, 1100)$
 $m = \frac{1100 - 100}{10 - 0} = \frac{1000}{10} = 100$

The speed of the car was 100 km/hr. during the entire trip.

b) The journey began 100 km from home. We know this because the line begins at 100 on the y-axis. The y-intercept is 100.

c) $y = mx + b$ Fill in the values from "a" and "b".
 $y = 100x + 100$

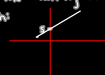
#6 a) Her weekly earnings does not depend on her sales, it only depends on the number of hours she works.
 b) $y = mx + b$ We need to find m (the slope) and b (the y-intercept)
 $m = \frac{y_2 - y_1}{x_2 - x_1}$ → We need 2 points from the graph:
 $(0, 0)$ and $(5, 40)$
 $m = \frac{40 - 0}{5 - 0} = \frac{40}{5} = 8$ $m = 8$
 $"b"$ is the y-intercept (where the line crosses the y-axis)
 $b = 0$

Equation is $y = 8x + 0$ or $y = 8x$

#7 a) To find out how much it costs to print each copy, we need to find the slope.
 $\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$ → We need 2 points
 $(0, 600)$ and $(100, 800)$
 $m = \frac{800 - 600}{100 - 0} = \frac{200}{100} = 2 = \frac{1}{5} = 0.5$
 It costs \$0.50 per copy or 50¢ per copy.

#7b. To find the cost to set up the printing equipment we need to find out (from the graph) how much we have to pay at first before making any copies. This is when x would equal zero.
 When is x zero? At \$600.
 This is also the y -intercept.
 c. $y=mx+b$ Fill in the values from "a" and "b".
 $y=0.50x+600$
 (y is the cost and x is the number of copies)

#8 a) $y=2x+5$
 -The hourly wage is \$2.00 per hour
 -The monthly fee is \$5.00.
 sketch:



a-f should have all been done this way
 -"b" and "c" should have negative slopes
 -"d" should have a negative y -intercept.
 You should have noticed that b, c, and f don't make sense as "internet providers"
 → the internet company is not going to pay you to use their internet.

#9 *Can only use #8 equations a, d, and e.
 a) To find out which is better, we need to fill in 13 in for x in each equation.
 $y=2x+5$ $y=0.5x+10$ $y=15+x$
 $y=2(13)+5$ $y=0.5(13)+10$ $y=15+13$
 $y=31$ $y=16.5$ $y=28$
 $y=31.00$ $y=16.50$ $y=28.00$
 I would use the internet provider " $y=0.5x+10$ " because it only costs \$16.50
 b) To find out which will give you the most number of hours for \$75.00 we need to fill in 75 for y in the equations.
 $y=2x+5$ $y=0.5x+10$ $y=15+x$
 $75=2x+5$ $75=0.5x+10$ $75=15+x$
 $70=2x$ $65=0.5x$ $60=x$
 $x=35$ $x=130$ $x=60$
 35 hours 130 hours 60 hours

#10 a) $y=mx+b$ fill the numbers in
 $y=3x+12.5$
 → \$12.50 for monthly fee
 → \$3.00 per hour of use
 Do the same for a, b, and c

#11 There are 2 ways to find the answer.

① Interpolating from the graph:
 \$115 → # of days

3 days

② Fill in 115 in for y

$$y=mx+b$$

slope

$$m=\frac{y_2-y_1}{x_2-x_1} \quad \text{Need 2 points}$$

(0,40) (2,90)

$$\frac{90-40}{2-0} = \frac{50}{2} \quad m=25$$

$$y=25x+40$$

$$115=25x+40$$

$$-40 \quad -40$$

$$75=25x \quad x=3$$

3 days

#12 To find the hourly cost we need to find the slope

$$\text{slope} = m = \frac{y_2-y_1}{x_2-x_1} \quad (1,310) \quad (6,610)$$

$$\frac{610-310}{6-1} = \frac{300}{5}$$

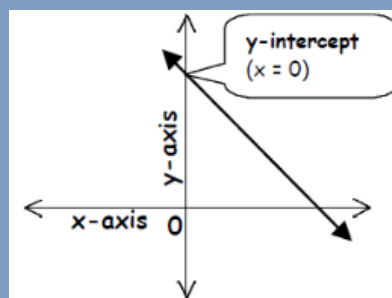
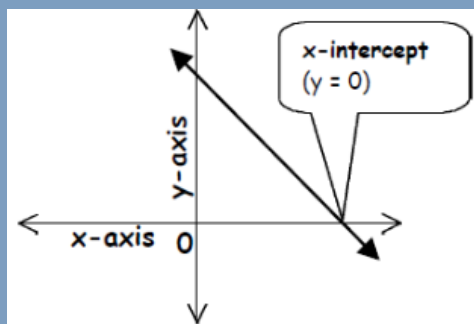
$$m=60$$

The hourly is \$60.

X and Y Intercepts:

X-intercept= the point where a graph crosses the x-axis;
the point where $y = 0$

y-intercept= the point where a graph crosses the y-axis;
the point where $x = 0$



How to Find The X & Y Intercept:

EX:

Determine the x-intercept for $2x + y = 8$.

Solution:

Let $y = 0 \rightarrow 2x + (0) = 8$

Solve for $x \rightarrow 2x = 8$

$x = 4$

x-intercept is $\rightarrow 4$ or $(4, 0)$

$(4, 0)$

Determine the y-intercept for $2x + y = 8$.

Solution:

Let $x = 0 \rightarrow 2(0) + y = 8$

Solve for $y \rightarrow y = 8$

y-intercept is $\rightarrow 8$ or $(0, 8)$

$(0, 8)$

Practice:

Find the x and y intercept for the following equations & write them in $y=mx + b$ form and find the intercepts (x and Y):

1. $3x + y = 9$

$(0, 9)$ $(3, 0)$
y-int. x-int.

2. $5x + y = 20$

$(0, 20)$ $(4, 0)$
x-int. x-int.

3. $\frac{3}{4}x + y = 8$

$(0, 8)$ $(10\frac{1}{3}, 0)$
y-int. x-int.

$3x + 0 = 8$
 $4 \cdot \left(\frac{3}{4}x\right) = (8) \cdot 4$
 $3x = \frac{32}{3}$
 $x = 10\frac{2}{3}$

Classwork/Homework

Copy & Complete

1. Rearrange the equations into the form $y=mx + b$:

a. $2x + 3y = 6$

b. $4x + 3y = 12$

c. $3x + y = 9$

d. $x + 4y = 8$

(these questions came from the yellow text Pg.111#1)

2. Find the x and y-intercepts

a. $4x + 5y = 20$

b. $3x - 4y = 12$

c. $2x + y = 4$

d. $5x + 3y = 15$

(these questions came from the yellow text Pg.111#2)

3. Create a table of values (at least 3 points) and graph:

a. $2x + y = 7$

b. $3x + y = 4$

c. $4x + y + 4 = 0$

d. $2x - y = 5$

(these questions came from the yellow text Pg.110 #7)

Answers

1. a. $y = -\frac{2}{3}x + 2$
 b. $y = -\frac{4}{5}x + 4$
 c. $y = -3x + 9$
 d. $y = -\frac{1}{4}x + 2$ $y = -\frac{x}{4} + 2$

2. x-int. (y=0) y-int. (x=0)
 a. $4x + 5y = 20$ $4x + 5y = 20$
 $4x + 5(0) = 20$ $4(0) + 5y = 20$
 $4x = 20$ $5y = 20$
 $\frac{4x}{4} = \frac{20}{4}$ $\frac{5y}{5} = \frac{20}{5}$
 $x = 5$ $y = 4$
x-int. = (5, 0) y-int. = (0, 4)
 b. x-int. = (4, 0) y-int. = (0, -3)
 c. x-int. = (2, 0) y-int. = (0, 4)
 d. x-int. = (3, 0) y-int. = (0, 5)

3. a) $2x + y = 7 \Rightarrow y = -2x + 7$

x	y = -2x + 7	y	(x, y)
1	-2(1) + 7	5	(1, 5)
2	-2(2) + 7	3	(2, 3)
3	-2(3) + 7	1	(3, 1)

y-int. $\Rightarrow (0, 7)$

Equation of a Line:

$$y = mx + b \quad (\text{Standard Form})$$

Slope

y-intercept

To find the equation of a line you need to determine:

1. a slope (m)
2. a point on the line (x, y)

$$y = \underline{\quad} x + \underline{\quad}$$

$$y = \underline{\quad} x + \underline{\quad}$$

How to Write The Equation of a Line:

7 Possible Situations that may be presented:

1. Given the slope and y-intercept
2. Given two points on the line
3. Given the graph of the line
4. Given the y-intercept and a point on the line
5. Given the x-intercept and a point on the line
6. Given the x-intercept and the y-intercept of the line
7. Given the slope and a point on the line

$$y = mx + b$$

$(2, 0)$

m

(x, y)

$y\text{-int} = 5$
 (b)

$(0, 5)$
 $x \quad y$

Situation #1:

Given the slope and the y-intercept

STEPS	EXAMPLE
	Find the equation of a line that, has a slope of -2 and a y-intercept of 4.
A) Substitute the slope and y-intercept into the formula, $y = mx + b$.	A) $m = -2, b = 4 \rightarrow y = -2x + 4$

Practice:

Write the equation of a line in standard form for the following:

1. slope = 5 y-intercept = -4

2. slope = $-2/3$ y-intercept = 2

EXAMPLE

Find the equation of a line that,
has a slope of -2 and a y-intercept of 4.

 m b

$$y = mx + b$$

$$y = -2x + 4$$

Situation #2:
Given two points on the line

STEPS**EXAMPLE**

Find the equation of a line that,
passes through points $(-1, 6)$ & $(1, 10)$

A) Determine the slope (m).A) two points $\rightarrow (-1, 6)$ & $(1, 10)$

$$\frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{10 - 6}{1 - (-1)}$$

$$= \frac{4}{1 + 1}$$

$$= \frac{4}{2} = 2$$

slope (m) = 2B) Substitute a point on the line and the slope into the formula, $y = mx + b$

B)

Point $(-1, 6)$ & $m = 2$ OR Point $(1, 10)$ & $m = 2$

$y = mx + b$

$(6) = (2)(-1) + b$

$y = mx + b$

$(10) = (2)(1) + b$

C) Solve for the y-intercept (b)

C)

$6 = -2 + b$

$6 + 2 = b$

$8 = b$

$10 = 2 + b$

$10 - 2 = b$

$8 = b$

y-intercept (b) = 8 or $(0, 8)$ D) Substitute the slope (m) and y-intercept into the formula, $y = mx + b$,D) $m = 2, b = 8 \rightarrow y = 2x + 8$

#2

EXAMPLEFind the equation of a line that,
passes through points $(-1, 6)$ & $(1, 10)$

$$y = mx + b$$

Find slope:

$$m = \frac{10-6}{1-(-1)} = \frac{4}{2} = 2 \quad (m=2)$$

$$y = 2x + b$$

Fill in any point into the equation
for x and y .

$$(1, 10)$$

 $x \quad y$

$$10 = 2(1) + b$$

Solve for b

$$10 = 2 + b$$

 $-2 \quad -2$

$$(8 = b)$$

$$y = 2x + 8$$

$$y = mx + b$$

Practice:

Write the equation of a line in standard form for the following:

1. $(2, 6)$
 $x \quad y$

$(-2, -2)$

2. $(2, 3)$ $(-1, -3)$

$$m = \frac{6 - (-2)}{2 - (-2)} = \frac{8}{4}$$

$$(m=2)$$

$$y \quad m \quad x$$

 $6 = 2(2) + b$

$$6 = 4 + b$$

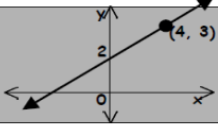
 $-4 \quad -4$

$$(2 = b)$$

$$y = 2x + 2$$

Situation #3: Given the Graph of the Line

- You need any 2 points to find slope (m)
- Find out where the line crosses the y-axis, this is your y-intercept (b)
- Fill in $y = \underset{\uparrow}{m}x + \underset{\uparrow}{b}$

STEPS	EXAMPLE	
	Find the equation of a line with the graph →	
A) Determine the y-intercept (b) by viewing the graph.	A) y-intercept = 2 or (0, 2)	
B) Substitute the y-intercept (b) and a point on the line (x, y) into the formula $y = mx + b$.	B) $b = 2$, point (4, 3) → $(3) = m(4) + (2)$	
C) Solve the equation for the slope (m).	$3 = 4m + 2$ $3 - 2 = 4m$ $1 = 4m$ $\frac{1}{4} = m$ <p style="text-align: right;">slope (m) = $\frac{1}{4}$</p>	
D) Substitute the slope (m) and y-intercept (b) into the formula, $y = mx + b$,	D) $m = \frac{1}{4}$, $b = 2$ → $y = \frac{1}{4}x + 2$	

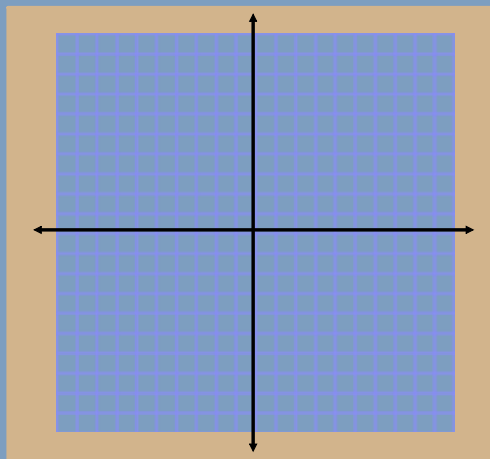
How do we graph an equation of a line in standard form?

- graph the co-ordinate that represents the y-intercept.

$$y = mx + b \quad \swarrow \text{y-intercept}$$

- graph another point by following the slope from the y-intercept.

Example: graph the linear equation $y = \frac{-2}{3}x + 2$

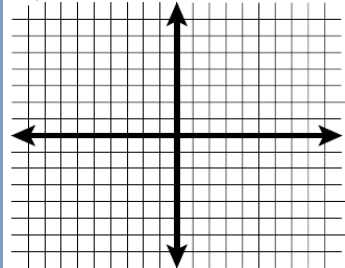


Practice:

Graph the following:

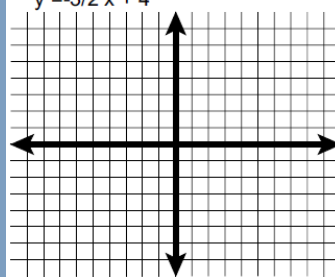
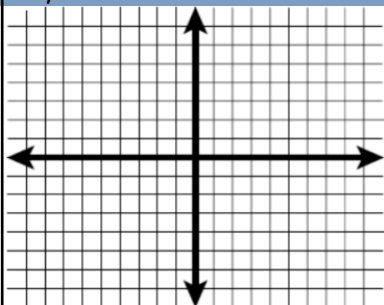
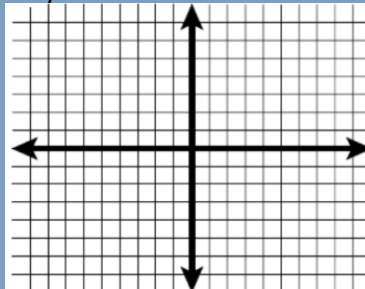
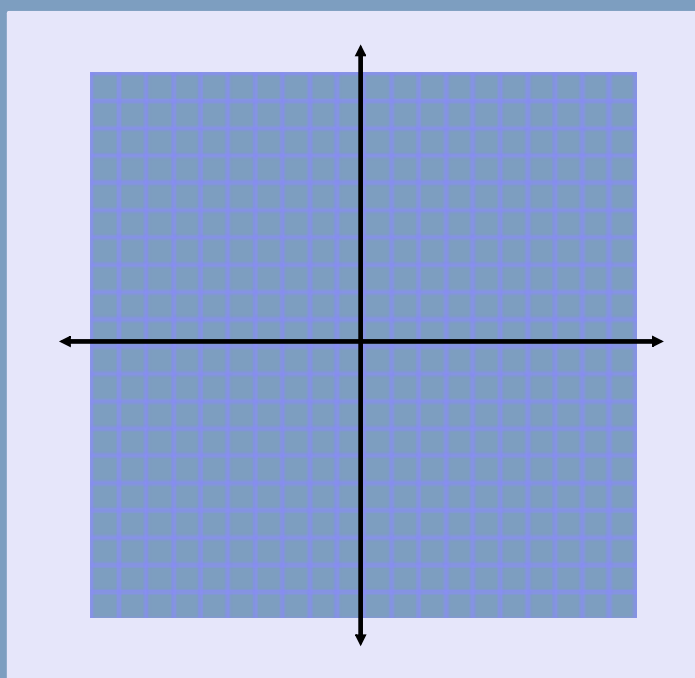
1.

$y = 3x - 5$



2.

$y = -\frac{3}{2}x + 4$

3. $y = -\frac{2}{5}x + 4$ 4. $y = 2x - 3$ What if we had to graph a linear equation?**Example:** Graph $y = 2x + 3$ 

Class work / Homework

Complete the assignment labeled:

3.4 Review Assignment.doc

Due Wednesday!



Situation #4:**Given the y-intercept and a point on the Line**

STEPS	EXAMPLE
	Find the equation of a line that, has a y-intercept of -3 and passes through (3, 4).
A) Substitute the y-intercept (b) and the point on the line (x, y) into the formula $y = mx + b$.	A) $b = -3$, point (3, 4) $\rightarrow (4) = m(3) + (-3)$
B) Solve the equation for the slope (m).	B) $4 = 3m - 3$ $4 + 3 = 3m$ $7 = 3m$ $7/3 = m$ slope (m) = $7/3$
C) Substitute the slope (m) and y-intercept (b) into the formula, $y = mx + b$,	C) $m = 7/3$, $b = -3 \rightarrow y = \frac{7}{3}x - 3$

EXAMPLE

Find the equation of a line that,
has a y-intercept of -3 and passes through (3, 4).

$$m$$

$$b = -3 \quad (0, -3)$$

$$m = \frac{4 - (-3)}{3 - 0} = \frac{7}{3}$$

$$y = mx + b$$

$$y = \frac{7}{3}x - 3$$

Practice:

1. y-intercept 5 ; point (3, -4)

2. y-intercept -3 ; point (1, -1)

Situation #5:

Given the x-intercept and a point on the Line

STEPS	EXAMPLE
	Find the equation of a line that, has an x-intercept of 2 and passes through (6, 2) .
A) Change the x-intercept to (x, y) form.	A) x-intercept of 2 → point (2, 0)
B) Determine the slope (m).	B) two points → (2, 0) & (6, 2) $m = \frac{RISE}{RUN} = \frac{\Delta y}{\Delta x}$ $= \frac{2-0}{6-2} \quad OR \quad = \frac{0-2}{2-6}$ $= \frac{2}{4} \quad OR \quad = \frac{-2}{-4}$ $= \frac{1}{2} \quad OR \quad = \frac{1}{2}$ <p style="text-align: center;">slope (m) = $\frac{1}{2}$</p>
C) Substitute a point on the line and the slope into the formula, $y = mx + b$	C) Point (2,0) & $m = 1/2$ <hr/> $y = mx + b$ $(0) = \frac{1}{2}\left(\frac{2}{1}\right) + b$
D) Solve for the y-intercept (b)	D) $0 = \frac{2}{2} + b$ $0 = 1 + b$ $-1 = b$ <hr/> y-intercept (b) = -1 or (0, -1)
E) Substitute the slope (m) and y-intercept (b) into the formula, $y = mx + b$,	E) $m = \frac{1}{2}$, $b = -1 \rightarrow y = \frac{1}{2}x - 1$

EXAMPLE
Find the equation of a line that, has an x-intercept of 2 and passes through (6, 2).

$y = mx + b$

$(2, 0)$

$$m = \frac{2-0}{6-2} = \frac{2}{4} = \frac{1}{2} = 0.5$$

$(2, 0)$ $y = 0.5x + b$

$0 = 0.5(2) + b$

$0 = 1 + b$

$-1 \quad -1$

$b = -1$

$y = 0.5x - 1$
(m) (b)

STEPS	EXAMPLE
	Find the equation of a line that, has an x-intercept of 2 and passes through (6, 2).

① x-intercept is 2 $\rightarrow (2, 0)$

Now, we have 2 points: $(2, 0)$ and $(6, 2)$

② Find slope(m) $\Rightarrow \frac{2-0}{6-2} = \frac{2}{4} \quad m = \frac{1}{2}$

③ Find the y-intercept

$y = mx + b$

Fill in: $2 = \left(\frac{1}{2}\right)(6) + b$

$2 = 3 + b$

$-3 \quad -3$

$-1 = b$

So, $y = mx + b$, $y = \frac{1}{2}x - 1$

Practice:

1. x-intercept = 5 ; point (-2, 5)

2. x-intercept = -3 ; point (1,1)

Situation #6:

Given the x-intercept and y-intercept of the Line

This is done the same as if you were given two points on the line. Convert the x and y-intercepts to (x, y) form and follow the same procedure when given two points on the line.

STEPS:	Example:
	y-intercept = 3 ; x-intercept = -2
A) Change both intercepts into points.	y-intercept = 3 (0,3) x-intercept = -2 (-2,0)
B) Find the slope	$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 3}{-2 - 0} = \frac{-3}{-2} = \frac{3}{2}$
C) Substitute the slope and a point into the equation $y = mx + b$.	$y = mx + b$ $y = \frac{3}{2}x + 3$
D) Solve for b.	
E) Substitute the slope and y-intercept into the equation $y = mx + b$.	

Example:

y - intercept = 3 ; x - intercept = -2

$$b = 3$$

$$m = ?$$

$$(0, 3)$$

$$(-2, 0)$$

$$m = \frac{3-0}{0-(-2)} = \frac{3}{2}$$

$$y = \frac{3}{2}x + 3$$

Situation #7:

Given the slope and a point on the Line

STEPS	EXAMPLE
A) Substitute the slope (m) and the point on the line (x, y) into the formula $y = mx + b$.	Find the equation of a line that, has a slope of 4 and passes through (5, 1) A) $m = 4$, point (5, 1) $\rightarrow (1) = (4)(5) + b$
C) Solve the equation for the y-intercept (b).	C) $1 = 20 + b$ $1 - 20 = b$ $-19 = b$ $y\text{-intercept } (b) = -19$
D) Substitute the y-intercept (b) and slope (m) into the formula, $y = mx + b$,	D) $m = 4$, $b = -19 \rightarrow y = 4x - 19$

$$m=4$$

$$b=?$$

EXAMPLE

Find the equation of a line that,
has a slope of 4 and passes through (5, 1)

x y

$$y = 4x + b$$

$$1 = 4(5) + b$$

$$1 = 20 + b$$

$$-20 \quad -20$$

$$-19 = b$$

$$y = 4x - 19$$

$(m) \quad (b)$

Practice:

1. slope = $-1/3$; point (1, -1)

2. Slope = $-1/3$ and y-intercept = -2

Equation of a line is: $y = mx + b$

- slope = m
- y-intercept = b

Questions:

1. How are we going to find the slope?
2. How are we going to find the y-intercept?

① One way is using 2 points $(m = \frac{y_2 - y_1}{x_2 - x_1})$

② Filling in the slope and a point into $y = mx + b$
 - solve for b
 - from a graph - where the line crosses the y-axis.

$$\textcircled{1} m = \frac{y_2 - y_1}{x_2 - x_1} \quad \textcircled{2} y = mx + b$$

Write your answer as
 $y = mx + b$
 $\uparrow \quad \uparrow$
 slope y-int

Rearranging Equations

$$\textcircled{1} \frac{A}{w} = \frac{lw}{w} \quad l = \frac{A}{w}$$

$$\textcircled{2} P = 2l + 2w$$

$$-2w \quad -2w$$

$$\frac{P - 2w}{2} = \frac{2l}{2}$$

$$l = \frac{P - 2w}{2}$$

Rearranging Equations Pg. 128, 129

Example #1:

$$3x + 2y - 12 = 0$$

$$-3x \quad -3x$$

$$2y - 12 = -3x$$

$$2y = -3x + 12$$

$$\frac{2y}{2} = \frac{-3x + 12}{2}$$

$$y = -\frac{3}{2}x + 6$$

Example #2:

$$A = \frac{l}{w}$$

Solve for l

$$l = \frac{A}{w}$$

Example #3:

$$p = 2l + 2w$$

Solve for l

$$p - 2w = 2l$$

$$\frac{p - 2w}{2} = \frac{2l}{2}$$

$$l = \frac{p - 2w}{2}$$

Example #4:

$$V = \pi r^2 h$$

Solve for h

$$h = \frac{V}{\pi r^2}$$

Example #5:

$$A = \frac{1}{2}bh$$

Solve for b

$$\frac{2A}{h} = \frac{bh}{h}$$

$$b = \frac{2A}{h}$$

Classwork

Finish and pass in your assignment and then work on the following questions, which are due on Friday.

- Pg. 123 #15, 16
- Pg. 125 # 21, 22bc, 25
- Pg. 127 #28, 29
- Pg. 129 #31, 33, 34

Your assignment **MUST** be passed in before the end of today. Extra help available today at lunch (help with either the assignment or the text questions).

Pg. 125

#2(a) $(2, 5)$ $m=4$

$$y = 4x + b$$

$$5 = 4(2) + b$$

$$5 = 8 + b$$

$$-8 \quad -8$$

$$b = -3$$

y -int $(0, -3)$

$21, 25, 33, 34 \text{ ab } 35 \text{ c}$

Eqn: $y = 4x - 3$

x -int: $(y=0)$

$$0 = 4x - 3$$

$$+3 \quad +3$$

$$\frac{3}{4} = \frac{4}{4}x \quad x = \frac{3}{4}$$

x -int $(\frac{3}{4}, 0)$

21(e) x -int $= 2$ $(2, 0)$

y -int $= -3$ $(0, -3)$

$$m = \frac{0 - (-3)}{2 - 0} = \frac{3}{2}$$

$y = \frac{3}{2}x - 3$

Answers

Pg. 123 #15, 16

#15) Alike? - all have a slope and y -int.
 - b and c have a y -int. of 2
 - a and c both have positive slopes.

Different? - all slopes are different
 - b has a neg. slope
 - c is not in the form $y=mx+b$

#16) Steeper? $\frac{2}{3}$ or $-\frac{5}{6}$ $\frac{2}{3} = \frac{4}{6}$

$-\frac{5}{6}$ is steeper because $\frac{4}{6}$ is less

than $\frac{5}{6}$

It doesn't matter if one is neg.

Answers

#21) a) $(2, 5)$ $m=4$ $y=mx+b$
 $y=4x+b$
 $5=4(2)+b$
 $5=8+b$
 $-8 -8$
 $-3=b$
 $y=4x-3$

b) $(-3, 1)$ $m=0$
 $y=mx+b$
 $1=0(-3)+b$
 $1=0+b$
 $1=b$
 $y=1$

c) $x\text{-int}=2$ $m=\frac{3}{4}=0.75$ $y=0.75x+b$
 $(4, 0)$ $0=0.75(4)+b$
 $0=3+b$
 $-3 -3$
 $-3=b$
 $y=\frac{3}{4}x-3$

d) $y\text{-int}=5$ $m=-\frac{1}{3}$
 $y=mx+b$
 $y=-\frac{1}{3}x+5$

e) $x\text{-int}=2$ $y\text{-int}=3$ $y=mx+b$
 $(2, 0)$ $(0, 3)$
 $m=\frac{y_2-y_1}{x_2-x_1}=\frac{-3-0}{0-2}=\frac{-3}{-2}=\frac{3}{2}$
 $y=\frac{3}{2}x-3$

#22) b) $(-3, 5)$ $(1, -2)$ $y=mx+b$
 $m=\frac{5-(-2)}{-3-1}=\frac{7}{-4}=-\frac{7}{4}$
 $y=-\frac{7}{4}x+b$
 $5=-\frac{7}{4}(-3)+b$ $y=-\frac{7}{4}x-\frac{1}{4}$
 $5=\frac{21}{4}+b$
 $5-\frac{21}{4}=\frac{20}{4}-\frac{21}{4}=-\frac{1}{4}=b$
 $-0.25=b$ $b=-\frac{1}{4}$

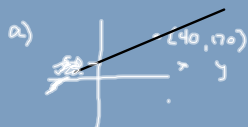
22. b) $y=-\frac{7}{4}x-\frac{1}{4}$ $x=?$ $y=12$
 $12=-\frac{7}{4}x-\frac{1}{4}$
 $48=-7x-1$
 $48+1=-7x-1+1$
 $49=-7x$
 $\frac{49}{-7}=\frac{-7x}{-7}$ $x=-7$

#25) $(\$6000, \$630)$ $y=mx+b$
 $(\$8000, \$790)$
 $a) y=mx+b$ $m=\frac{790-630}{8000-6000}$
 $m=\frac{160}{2000}$
 $m=0.08$
 $y=0.08x+b$
 $630=0.08(6000)+b$
 $630=480+b$
 $-480 -480$
 $b=150$
 $y=0.08x+150$

d) $y=0.08(10000)+150$
 $y=800+150$
 $y=950$
 $\$950$

e) $950=0.08x+150$
 $-150 -150$
 $800=0.08x$
 $\frac{800}{0.08}=\frac{0.08x}{0.08}$ $x=10000$
 $\$10000$

Pg. 127 #28, 29

28. $(40, 170)$ $m=3$ 

b)

$$y = mx + b$$

$$y = 3x + b$$

$$170 = 3(40) + b$$

$$170 = 120 + b$$

$$\begin{array}{r} -120 \\ -120 \end{array}$$

$$y = 3x + \underline{50}$$

$$\boxed{b = 50}$$

d) membership fee of \$50/year

e) yes, it has an x-intercept.
No, it does not make sense.

#29 $y = 2x + 10$

a) The y-intercept will change from $(0, 10)$ to $(0, 20)$.

b) The slope would change from 2 to 1.50.
(less steep).

Classwork/Homework

Answer questions Pg. 129 #31, 33, 34

#31 Both use the same methods.
solo. eqn = answer

#33 $\frac{W}{t} = \frac{P}{t}$ $W = Pt$

#34. a) $\frac{I}{P} = \frac{R}{P}$ $t = \frac{I}{P}$

b) $P = \frac{I}{t} + \frac{2W}{t}$ 2

$\frac{P-2W}{2} = \frac{I}{2}$ $2 = \frac{P-2W}{2}$

c) $V = D \cdot m$ $m = Dv$

d) $A = \frac{1}{2}bh$ $b = \frac{2A}{h}$

e) $V = \frac{1}{2}wh$ $h = \frac{V}{\frac{1}{2}w}$

f) $V = \frac{4}{3}\pi r^3$ $r = \sqrt[3]{\frac{3V}{4\pi}}$

g) $a = bc + d$ $c = \frac{a-d}{b}$

Pg. 129

$$\# 33. \quad t \cdot P = \frac{W}{t} \cdot t \quad W = ?$$

$$Pt = W \quad W = Pt$$

$$\# 34. \quad f) \quad V = \frac{\pi r^2 h}{\pi r^2} \quad h = ?$$

$$h = \frac{V}{\pi r^2}$$

$$d) \quad 2 \cdot A = \frac{1}{2} b h \cdot 2 \quad b = ?$$

$$\frac{2A}{h} = \frac{bh}{h} \quad b = \frac{2A}{h}$$

$$\# 33 \quad t \cdot P = \frac{W}{t} \cdot t \quad W = ?$$

$$W = Pt$$

$$\# 34 \quad f) \quad V = \frac{\pi r^2 h}{\pi r^2} \quad h = ?$$

$$h = \frac{V}{\pi r^2}$$

$$d) \quad 2 \cdot A = \frac{1}{2} b h \cdot 2 \quad b = ?$$

$$\frac{2A}{h} = \frac{bh}{h}$$

$$b = \frac{2A}{h}$$

Attachments

Sec 3.4 - Slopes.doc

Sec 3.4 - Write the equation of a line (1).doc

3.4 Review Assignment.doc

sec. 3.4 - Write the equation of a line (2).doc